



Seat Belt Assembly – In Vehicle Evaluation

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. To evaluate a seat belt assembly as installed in a vehicle. Evaluations are made with respect to noise, retractor sensitivity, extraction/retraction efforts, susceptibility to abrasion/twisting of the webbing and retractability at cold temperatures.

1.2 Applicability. This procedure applies to all seat belt assemblies for development purposes and not validation.

1.2 Remarks. This procedure focuses on the seat belt assembly from the customer's view point. Although these tests tend to be less accurate than those tests performed in the laboratory, the influence of the vehicle environment on the seat belt assembly's performance is paramount. Extraction/retraction efforts certification tests should be conducted in the laboratory.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14624 GMW14832

2.3 Additional References.

- American National Standard for Calibration, Calibration Laboratories and Measuring and Test Equipment – General Requirements
- Seat Belt Assembly Drawing

3 Resources

3.1 Facilities.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.1.3 Milford Proving Ground test roads or Global Equivalent Roads in other regions.

3.1.4 Thermal chamber capable of housing a vehicle and achieving specified temperatures in this standard.

3.2 Equipment.

3.2.1 Proper model vehicle with retractors to be tested.

3.2.2 Force gauge (i.e., 25 N capacity).

3.2.3 Acceleration gauge.

3.2.6 Tape measure.

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November 2017

Page 1 of 9

3.2.7 Masking tape.

Note: All equipment must be calibrated in accordance with American National Standard for Calibration, Calibration Laboratories and Measuring and Test Equipment – General Requirements.

3.3 Test Vehicle/Test Piece. A vehicle with appropriate:

- Seats
- Seat belts
- Column/wheel
- Doors
- Door trim
- Any and all other parts which may contact belts during occupant use

Note: Ensure the seat belt anchorages and H-point locations on the test vehicle are to design intent.

3.4 Test Time. The following is an estimate on the amount of time (work-hours) needed to perform this procedure.

Calendar time:	4 days
Test time:	6 h
Coordination time:	8 h

3.5 Test Required Information. Seat Belt Assembly Drawing.

3.6 Personnel/Skills. A skilled technician or an engineer can perform this test procedure. Test personnel shall have a working knowledge privileges as follows:

- Accelerometers (selection, mounting and calibration) for Panic Braking
- Driving privileges on the Global Proving Grounds Test Roads/Tracks (i.e., Development Engineer, Noise, Vibration and Harshness (NVH) Engineer)
- Squeak and rattle root source analysis methods
- A general knowledge of the product being tested

4 Procedure

4.1 Preparation. Not applicable.

4.2 Conditions.

4.2.1 Environmental Conditions.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions.

4.3.1 Noise Evaluation.

4.3.1.1 Install the seat belt assemblies and all interior trim on the test vehicle.

Note: The test vehicle should be free of rattles.

4.3.1.2 Subjectively evaluate each retractor with respect to the noise produced during the normal extraction and retraction of the webbing per the attached GM Subjective Rating Scale (reference GMW14624).

Note: 4.3.1.2 and 4.3.1.3 are to be performed with the vehicle parked in a quiet environment.

4.3.1.3 If the retractor is located in proximity to a radio speaker, check if the speaker vibration can cause the retractor to rattle. Play the radio at different volume and bass levels to determine if the speaker can cause the retractor to rattle.

4.3.1.4 Drive the vehicle over the roads in Table 1 or equivalent and subjectively evaluate each seat belt assembly/retractor for noise per the attached GM Subjective Rating Scale (reference GMW14624).

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November 2017

Page 2 of 14

Table 1: Road Type and Driving Speed

MPG Suggested Road or Global Equivalent Roads in other Regions	Speed
Pontiac Trail	(56.3 to 72.4) km/h ((35 to 45) mph)
Gravel Roads	(40.2 to 64.4 km/h ((25 to 40) mph)
Oval Track Tar Strips	(64.4 to 88.5) km/h ((40 to 55) mph)
Inclined Surfaces	(56.3 to 72.4) km/h ((35 to 45) mph)
Belgium Blocks	(48.3 to 56.3) km/h ((30 to 35) mph)

MPG

Milford Proving Ground

Note: Retractor evaluations should be performed with the webbing fully stowed and repeated with the belt assembly in use. Note in the evaluation, if the latch plates or buckles tend to rattle.

4.3.2 Panic Braking.

Note: This test requires two people to properly evaluate each retractor.

4.3.2.1 Install the seat belt assemblies into the proper model vehicle.

4.3.2.2 Set up and calibrate the acceleration gauge to measure the deceleration of the vehicle.

4.3.2.3 Operate the vehicle over a smooth and level surface.

4.3.2.4 Gradually apply the brakes and slow the vehicle at a deceleration rate of 0.4 G.

4.3.2.5 As the vehicle is decelerating, slowly extract webbing from the retractor being tested.

4.3.2.6 If the retractor did not lock-up, increase the deceleration rate by 0.1 G and repeat the test. If the retractor locked-up, repeat the test at the same deceleration level.

4.3.2.7 Continue the test until the retractor locks-up three times consecutively at the same rate of deceleration. Record this rate of deceleration.

4.3.2.8 Repeat 4.3.2.3 through 4.3.2.7 for each retractor to be tested.

Note: The sensitivity of the retractor is roughly the minimum deceleration level in which three consecutive lock-up conditions were observed. A more precise measurement of the retractors sensitivity may be obtained in the laboratory.

4.3.3 Extraction/Retraction Efforts.

4.3.3.1 Install the seat belt assembly into the proper model vehicle. Note the vehicle must contain all hardware and trim that contacts the belt assembly.

4.3.3.2 Refer to the Seat Belt Assembly Drawing for the following information;

- Full stow of webbing by design
- The working range of the comfort mechanism
- The direction and effort specification for extraction and retraction

4.3.3.3 Mark the webbing for 75% of full extraction and 50 mm (2 in) from full stow position.

4.3.3.4 If the belt system includes a seat mounted webbing guide, perform 4.3.3.5 through 4.3.3.7 with the seat:

- full rearward and down (if power adjustable) and with the seat
- in the full forward and up position.

4.3.3.5 Close the door to engage the comfort mechanism (if applicable).

4.3.3.6 Extend the belt to 75% of full extension and hook the webbing to the force gauge.

4.3.3.7 Measure the extraction/retraction efforts at 75% $\pm$ 25 mm (1 in) of webbing.

Note: Pull the webbing in the direction specified on the Seat Belt Assembly Drawing.

4.3.3.8 Open the door to disengage the comfort mechanism (if applicable) and repeat 4.3.3.7.

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November 2017

Page 3 of 14



Documents

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4.3.3.9 With the comfort mechanism off, measure the extraction/retraction efforts at (50 ± 25) mm $((2 \pm 1)$ in) from full stow.

4.3.3.10 Repeat 4.3.3.4 through 4.3.3.9 at 71 °C and -29 °C (160 °F and -20 °F), if specified.

4.3.4 Nuisance Locks.

Note: This test requires two people to properly evaluate each retractor.

4.3.4.1 Install the seat belt assemblies into the proper model vehicle.

4.3.4.1.1 Static Evaluation: Pull the seat belt webbing from its full stowed condition and insert the latch plate into buckle. Check for locking of the seat belt retractor while donning the seat belt (execute by using both a right hand and a left hand operation).

4.3.4.1.2 Dynamic Evaluation: While wearing the seat belt system, check for locking of the seat belt retractor over the following road conditions by slowing extracting the webbing and allowing the webbing to retract:

- a. 72 km/h (45 mph) on 12 Mile Road at Milford Proving Ground (MPG) in both directions or Global Equivalent Road in other Regions.
- b. 105 km/h (65 mph) on the 3rd lane of MPG oval track between mile markers (2.8 to 0.1), 1.98 km (0.9 mi) or Global Equivalent Road in other Regions.

4.3.4.2 Assess the seat belt system performance per GM Subjective Rating Scale GMW14624 for 4.3.4.1.1 and 4.3.4.1.2.

4.3.4.3 Repeat 4.3.4.1.1 through 4.3.24.2 for each retractor to be tested.

4.3.5 Susceptibility to Webbing Wear, Twisting and Jam.

4.3.5.1 Install the seat belt assembly, all hardware and trim that contacts the belt assembly into the proper model vehicle.

4.3.5.2 Sit in the seat that corresponds to the belt assembly to be tested.

4.3.5.3 Buckle up the seat belt assembly, and then unbuckle the belt and return it to full stowage. Repeat this cycle using different seat positions and motions that simulate customer usage.

4.3.5.4 Note any interior trim or surfaces that contact the belt during extraction or retraction. These surfaces could potentially cause the webbing to wear.

4.3.5.5 Repeat this evaluation with the seat in full forward, mid travel and full rearward positions.

4.3.5.6 Extract the webbing fully from the retractor and twist the webbing in varying degrees.

4.3.5.7 Check if the twisted webbing is able to retract through the guide loop and/or into the retractor assembly.

4.3.5.8 With the vehicle door open, extend the seat belt assembly fully (leave door closed when testing a passive system).

4.3.5.9 Release the belt back into the retractor(s) in a manner that simulates customer usage. Repeat this cycle with different motions to determine if the webbing consistently retracts fully into the retractor.

4.3.5.10 Repeat 4.3.5.8 and 4.3.5.9 at the cold and hot specified temperatures -29 °C and 71 °C (-20 °F and 160 °F).

4.3.6 Latch Plate Stowage Performance at Temperature Extremes – Single Loop Systems.

4.3.6.1 Place a vehicle in the cold room at -30 °C (-22 °F) (unless specified otherwise) for a minimum of 6 h.

4.3.6.2 Position the latch plate such that it is 25 mm (1 in) from the guide loop when the belt is fully stowed (belt assemblies with adjustable latch plates).

4.3.6.3 Cycle the belt assembly three times by extracting 800 mm (31.5 in) of webbing from the retractor and allowing it to retract.

4.3.6.4 Extract 800 mm (31.5 in) of webbing from the retractor and hold the webbing such that the webbing forms an angle that is 45 degrees downward and forward of the guide loop.

4.3.6.5 Release the belt and record the time required for the webbing to retract to within 25 mm (1 in) of full storage.

4.3.6.6 Repeat 4.3.6.4 and 4.3.6.5 two additional times for a total of three measurements.

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November 2017

Page 4 of 14



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4.3.7 Latch Plate Stowage Performance at Temperature Extremes.

4.3.7.1 Place a vehicle in the cold room at 29 °C (-20 °F) (unless specified otherwise) for a minimum of 6 h.

4.3.7.2 Cycle the belt assembly three times by extracting 300 mm (12 in) of webbing from the shoulder belt retractor and 610 mm (24 in) of webbing from the lap belt retractor and allowing the belts to retract.

4.3.7.3 Grasp the latch plate and extract webbing from the lap and shoulder belt retractors and hold the latch plate in a position such that:

- a. A 300 mm (12 in) length of webbing is extracted from the shoulder belt retractor.
- b. The shoulder belt webbing forms an angle that is 45 degrees forward and downward from the guide loop.

4.3.7.4 Release the belt and record the time required for both belts to retract within 50 mm (2 in) of full storage.

4.3.7.5 Repeat 4.3.7.3 and 4.3.7.4 two additional times for a total of three measurements.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. Refer to GMW14832 (SSTS) for Engineering Requirements.

5.3 Test Documentation. Record pertinent test results on Data Sheets A1 through A6 (Appendix A).

6 Safety

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

7 Notes

7.1 Glossary. Not applicable.

7.2 Acronyms, Abbreviations, and Symbols.

in	Inch
mm	Millimeter
NVH	Noise, Vibration and Harshness
Sec	Second
VIN	Vehicle Identification Number
WOS	Webbing on Spool

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Test to GMW14793

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November 2017

Page 5 of 14



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